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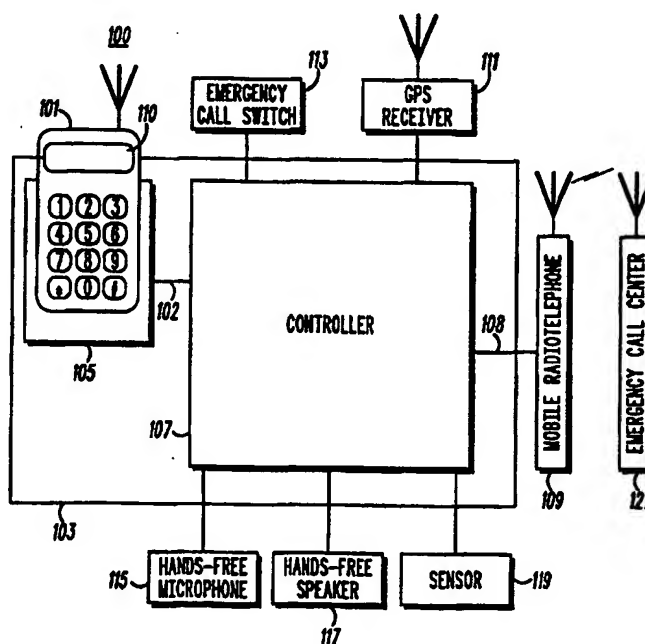
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: **PORTABLE-MOBILE RADIOTELEPHONE ARCHITECTURE AND METHOD FOR MOBILE PERSONAL SECURITY SYSTEMS**

(57) Abstract

A portable-mobile personal security system and method for a vehicle includes establishing a telephone call (407) from a portable radiotelephone (101) through a mobile radiotelephone (109). The telephone call established from the portable radiotelephone (101) is aborted (413) when a sensing device (119) indicates an emergency condition. Then, an emergency telephone call is made to an emergency-call center (415) through the mobile radiotelephone (109). While the emergency telephone call is in progress, a geographic position of the vehicle is transmitted to the emergency-call center (417). Additionally, a display (110) on the portable radiotelephone (101) displays status information about the emergency telephone call.



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## PORTABLE-MOBILE RADIOTELEPHONE ARCHITECTURE AND METHOD FOR MOBILE PERSONAL SECURITY SYSTEMS

### Field of the Invention

5

This invention is related to the field of mobile personal security systems for use in vehicular applications.

### Background of the Invention

10 Contemporary mobile personal security systems include a position determining component – such as a Global Positioning System (GPS), and a radio communication sensing device – such as a cellular phone, to alert an emergency-call center of an emergency situation for a vehicle's operator. These mobile personal security system's can not only alert  
15 the emergency-call center with information concerning the nature of the emergency, but with the aid of the GPS, a position of the vehicle. This is convenient, because if a vehicle breaks down, or is in an accident, help can be send out to a precise location to remedy the emergency situation.

20 One problem with contemporary mobile personal security system's, is that they use mobile radiotelephones, that is, phones permanently installed in a vehicle. This is problematic because more and more people are using portable radiotelephones. Today, if someone wanted to have both a portable radiotelephone, and an mobile  
25 personal security system, that person would have two separate

telephones and two separate telephone services, one used in the vehicle to operate the mobile personal security system, and one used to operate the portable radiotelephone. This is not only costly, but very inconvenient. Moreover, if the vehicle operator wanted to use the  
5 mobile radiotelephone's high power transceiver with his portable radiotelephone while in the vehicle, it will require redundant components including an antenna coupler, and a hands-free digital controller.

What is needed is an improved architecture for mobile personal  
10 security system's that includes provision for portable radiotelephones that is not complex and is cost-effective.

### Brief Description of the Drawings

FIG. 1 is a system block diagram of a mobile personal security system in accordance with a preferred embodiment of the invention;

5        FIG. 2 is a flow chart of a method in accordance with one aspect of the preferred embodiment of the invention;

FIG. 3 is a flow chart of a method in accordance with a second aspect of with the preferred embodiment of the invention;

FIG. 4 is a flow chart of a method in accordance with a third  
10    aspect of with the preferred embodiment of the invention; and

FIG. 5 is a flow chart of a method in accordance with a fourth aspect of with the preferred embodiment of the invention.

### Detailed Description of a Preferred Embodiment

A portable-mobile personal security system and method for a vehicle includes establishing a telephone call from a portable  
5 radiotelephone 101 through a mobile radiotelephone 109. The telephone call established from the portable radiotelephone 101 is aborted when a sensing device indicates an emergency condition. Then, an emergency telephone call is made to an emergency-call center 121 through the mobile radiotelephone 109. While the emergency  
10 telephone call is in progress, a geographic position of the vehicle is transmitted to the emergency-call center 121. Additionally, a display on the portable radiotelephone 101 displays status information about the emergency telephone call. The improved system and method will be better understood by reviewing the figures.

15 FIG. 1 is a system block diagram of a mobile personal security system 100 in accordance with a preferred embodiment of the invention. A portable radiotelephone 101 is coupled to an adapter 103. The adapter 103 consists of a cradle 105, for physically captivating the portable radiotelephone 101, and a controller 107 which connects to the  
20 portable radiotelephone 101 through the cradle 105. The cradle 105 had a switch that indicates whether or not the portable radiotelephone 101 resides in the cradle 105. The connection is made across a portable or P-data bus which transceives information between the portable radiotelephone 101 and a controller 107. Note that although the  
25 transfer of information between the portable radiotelephone 101 and

the controller 107 is shown to occur over the P-data bus, other communication means could easily be implemented.

A mobile radiotelephone 109 is connected to the controller 107 using a mobile or M-data bus 108. The controller 107 is also connected  
5 to a GPS receiver 111, an emergency call switch 113, a hands-free microphone 115, a hands-free speaker 117, and a sensor 119. The sensor is used to indicate an emergency condition – such as a crash of the vehicle. An accelerometer can be used to sense and indicate a crash. Other types of sensors can also be used to indicate an emergency  
10 condition. For example a tire pressure sensor could sense and indicate a flat tire.

The controller 107 is preferably constructed comprising a Motorola MC68332 microcontroller 107. The Motorola MC68332 microcontroller 107 is programmed to execute the preferred method  
15 steps described later in the attached flow charts. Many other implementations are possible without departing from the essential teaching of this embodiment. For instance another microcontroller 107 could be used. Additionally, a dedicated hardware circuit based control system, controlled in accordance with the teachings of this treatise.

20 Positioning mechanisms other than the GPS receiver 111 may also be used to sense and indicate the vehicle's position. The vehicle's position is not required to be geographic, but merely indicative of an identifiable position.

Essentially, while the portable radiotelephone 101 is captivated in  
25 the cradle 105, the portable radiotelephone 101 is used as a peripheral

to the mobile radiotelephone 109. The radio frequency transmission and reception components i.e. power amplifier and antenna, of the portable radiotelephone 101 are not used in the transmission and reception of a telephone call while the portable radiotelephone 101 is captivated in the cradle 105. A power amplifier, and antenna of the mobile radiotelephone 109 are used for the radio frequency transmission and reception of telephone calls while the portable radiotelephone 101 is captivated in the cradle 105. In this case the portable radiotelephone 101 is employed as the user interface in the personal security system 100. For instance the portable radiotelephone 101 is sometimes used for audio input and output, and provides the mobile personal security system with certain personality parameters, such as turbo-dial memory numbers, and billing-specific information if needed. When the portable radiotelephone 101 is removed from the cradle 105, the portable radiotelephone 101 uses it's own power amplifier and antenna components for radio frequency transmission and reception.

Four different applications will be described next; a hands-free telephone call using portable radiotelephone 101 inside the vehicle; an emergency call request; a hands-free telephone call interrupted by emergency call request; and a handset telephone call.

FIG. 2 shows a preferred method for operating the mobile personal security systems when the user makes a hands-free telephone call. The method steps shown in FIG.s 2-5 are preferably embedded into program memory of a Motorola MC68HC332 microcontroller 107



indigenous to the controller 107 introduced in FIG. 1. Alternatively, the method steps could be implemented on another type of controller 107.

5 The method is invoked in step 201 when the user powers-on the portable radiotelephone 101. When the user powers-on the portable radiotelephone 101 the portable radiotelephone 101 generates a portable-power-on signal onto the P-data bus 102.

10 The controller 107 intercepts the portable-power-on signal generated by the portable radiotelephone 101 from the P-data bus 102 and in-turn powers-on the mobile radiotelephone 109 into a hands-free mode via the M-data bus as shown in step 203.

After the user dials a telephone number on the portable radiotelephone 101 this information is transferred to the P-data bus 102 through the controller 107 through the M-data bus 108 to the mobile radiotelephone 109, as shown in step 205.

When the user presses a "SEND" Key on the portable radiotelephone 101 a send-call command code is transferred from the portable radiotelephone 101 over the P-data bus 102 through the controller 107 onto the M-data bus 108 to the mobile radiotelephone 109 which dials the telephone number as shown in step 207. Also in step 207, the controller 107 sends an end-call command code over the P-data bus 102 to the portable radiotelephone 101, which prevents the portable radiotelephone 101 from actually dialing the telephone number that the user entered into the portable radiotelephone 101. The portable radiotelephone 101 will still be used to display call status information on its visual display 110.

Next, step 209 illustrates that the user talks and listens as the user ordinarily would using the portable radiotelephone 101 in hands-free mode using the hands-free microphone 115 and the hands-free speaker 117, rather than the built-in microphone and speaker of the portable  
5 radiotelephone 101.

When the user wants to terminate the telephone call in-progress the user presses an "END" key on the portable radiotelephone 101 which in turn generates an end-command code which is transferred over the P-data bus 102 through the controller 107 by way of the M-data bus 108 to the  
10 mobile radiotelephone 109 to terminate the telephone call as shown in step 211. This completes the description of the first case, that of the user placing a hands-free telephone call.

As summary of the actions taken in the method steps shown in FIG. 2 are shown next in table form.

TABLE 1

user's actions / observations	mobile personal security system actions	portable radiotelephone status	mobile radiotelephone status
depress the portable radiotelephone "power-on" key	reads P-data bus	on	off
	turns mobile radiotelephone on in hands-free mode	on	on
dial a telephone number	reads numbers from P-data bus	dial	on
listen to the telephone call being placed via the hands-free speaker	echo numbers being dialed on M-data bus	dial	dial
depress the "send-call" key on the portable radiotelephone	reads send from P-data bus	send-call	dial
	send "end-call" command code to portable radiotelephone	terminate call	wait for send key
	send "send-call" command code to mobile radiotelephone		send-call
hands-free call in progress	monitor both data bus portable radiotelephone and mobile radiotelephone	on - no radio frequency power	call
depress the "end" key on the portable radiotelephone	reads "end-call" command code from portable radiotelephone		
listen to the telephone call being dropped via the hands-free speaker	sends "end-call" command code to mobile radiotelephone		terminates call

Next, an emergency call request will be described. FIG. 3 illustrates the preferred method for handling an emergency call request using the mobile personal security system. A request for an emergency call can be initiated by one of several methods. For instance, the vehicle mounted sensor 119 can sense a dangerous situation such as a crash of the vehicle. An emergency call can also be initiated directly by the user by activating the emergency call switch 113 when the user requires emergency

assistance. This may happen for instance if the user who is operating the vehicle gets a flat tire.

In a first step of the preferred method 301, a request for an emergency call is initiated by one of the several methods described.

5       The controller 107 senses the request of an emergency call either by reading the emergency call switch 113, or reading data from the sensor 119, and powers-on the mobile radiotelephone 109 into hands free mode as shown in step 303.

10       Next, in step 305 the controller 107 powers-on the portable radiotelephone 101. Note that although that the portable radiotelephone 101 is powered-on its radio frequency power section is not enabled because it won't be used.

15       Then in step 307, the controller 107 commands the mobile radiotelephone 109 to initiate an emergency telephone call in response to the request for an emergency call. Note that the emergency call status is displayed on the portable radiotelephone 101 display 110.

20       Step 311 shows that the emergency call is processed by the emergency call center. This may include sending the vehicle's position information which is read from the GPS receiver 111 by the controller 107, and sent across the M-data bus 108 through the mobile radiotelephone 109 to the emergency call service center.

25       Next, in step 313 the mobile radiotelephone 109 receives an end-call command code from the emergency call center and terminates the emergency telephone call. At this time, the portable radiotelephone 101 displays an end-call status on its display 110, as shown in step 315.

Then, in step 317 the controller 107 powers-off both the mobile radiotelephone 109 and the portable radiotelephone 101 by sending the appropriate power-off commands through the M-data bus 108 and the P-data bus 102 respectively. This completes the description of the second  
5 case, that of an emergency call request.

As summary of the actions taken in the method steps shown in FIG. 3 are shown next in table form.

TABLE 2

user's actions / observations	mobile personal security system actions	portable radiotelephone status	mobile radiotelephone status
depress the emergency call switch	read emergency switch	off	off
	turns mobile radiotelephone on in hands-free mode		on
	turn portable radiotelephone on	on - no radio frequency power	on
listen to call being placed hands-free	dials emergency number through M-data bus		dial
monitor status call through portable radiotelephone display	send-call status information to portable radiotelephone display data bus	display call status	
	send "send-call" command code to mobile radiotelephone		send-call
	monitor both data bus portable radiotelephone and mobile radiotelephone		call
	read "end-call" from modem emergency call center		
listen to call being dropped	send "end-call" command code to P-data bus & M-data bus	display "end-call"	terminates call
	turns mobile radiotelephone & portable radiotelephone off	off	off

Next, a hands-free telephone call will be interrupted by an emergency  
5 call request.

FIG. 4 shows a preferred method for operating the mobile personal security systems while the user is making a hands-free telephone call that gets interrupted by an emergency call request. In step 401 the user powers-on the portable radiotelephone 101 which generates a portable  
10 radiotelephone power-on signal onto the P-data bus 102.

Next, in step 403 controller 107 reads the portable radiotelephone power-on signal from the P-data bus and commands the mobile

radiotelephone 109 to power-on in a hands-free mode by sending a command code over the M-data bus 108.

While the user dials a telephone number on the portable radiotelephone 101, this number is transferred over the P-data bus 102  
5 through the controller 107, across the M-data bus 108, to the mobile radiotelephone 109, as shown in step 405.

Then, in step 407 the mobile radiotelephone 109 receives a send-call command code from the portable radiotelephone 101, and the controller 107 sends an end-call command code to the portable radiotelephone 101  
10 via the P-data bus 102 while the mobile radiotelephone 109 initiates a telephone call.

Next, in step 409 the user talks and listens to his intended conversation using the portable radiotelephone 101 in hands-free mode.

Sometime during the ongoing telephone call, a request for an  
15 emergency call is initiated as shown in step 411. As noted earlier this request can be automatically generated by reading data from the sensor 119 or also initiated by the user if the user activates the emergency call switch 113, or alternatively by depressing a combination of two  
20 keystrokes on the portable phone, if a separate emergency call switch is not installed.

Next, as shown as step 413, the current telephone call is aborted by the controller 107 which sends an end-command code across the M-data bus 108 to the mobile radiotelephone 109 which in-turn hangs up.

Next, in step 415 an emergency telephone call is initiated to the  
25 emergency call center from the mobile radiotelephone 109 under the command of the controller 107.

Once connected, the emergency call is processed by the emergency call center as shown in step 417. Optionally, the position of the vehicle which is determined by the GPS receiver 111 may be sent to the emergency call center.

5        Then, in step 119 when the emergency call is complete, the emergency call center terminates the call by sending an end-call command code to the mobile radiotelephone 109. Once the end-call command code is received by the mobile radiotelephone 109 it transfers it by way of the M-data bus 108, through the controller 107, onto the P-data bus 102, and  
10        the portable radiotelephone 101 displays the end-call status on its display 110.

Then, in step 421 the controller 107 powers-off both the mobile radiotelephone 109 and the portable radiotelephone 101.

As summary of the actions taken in the method steps shown in  
15        FIG. 4 are shown next in table form.



TABLE 3

user's actions / observations	mobile personal security system actions	portable radiotelephone status	mobile radiotelephone status
place a telephone call on portable radiotelephone		on	on
hands-free call in process		on	call
depress the emergency call switch	read emergency switch	on	call
observe call aborted	send "end" command code to mobile radiotelephone	display end-call on internal display	terminates call
listen to emergency call being placed hands-free	dials emergency number through M-data bus	on – but no radio frequency power	dial
monitor status call through portable radiotelephone display	send call status information to portable radiotelephone display data bus	display call status on internal display	
	send "send-call" command code to mobile radiotelephone		send-call
	monitor both data bus portable radiotelephone and mobile radiotelephone		call
	read "end-call" from modem emergency call center		
listen to call being dropped	send "end-call" command code to P-data bus & M-data bus	display "end-call"	terminates call
	turns mobile radiotelephone & portable radiotelephone off	off	off

Next, a preferred method for the mobile personal security systems to handle a handset telephone call is described. FIG. 5 shows a preferred method for operating the mobile personal security systems while the user is making a handset telephone call. This means that the user wants to listen and talk using the speaker and microphone built into the portable radiotelephone, rather than in hands-free mode using the hands-free speaker 117 and hands-free microphone 115. Note that emergency calls are connected in hands-free mode for safety. If a

handset telephone call is in progress, the mobile personal security system will abort the call and re-dial emergency number in hands-free mode as described earlier.

5

TABLE 4

user's actions / observations	mobile personal security system actions	portable radiotelephone status	mobile radiotelephone status
depress portable radiotelephone on key	reads P-data bus	on	off
	turns mobile radiotelephone on in hands-free mode	on	on
dial telephone number	reads numbers from P-data bus	dial	on
listen to call being placed hands-free	echo numbers being dialed on M-data bus	dial	dial
depress send key	reads "send-call" command code from P-data bus	send-call	dial
	send "end-call" command code to portable radiotelephone	terminate call	wait for "send-call" command code
	send "send-call" command code to mobile radiotelephone		send-call
user picks up portable radiotelephone from its cradle but still linked to it by an extension cord	detects "off-cradle" switch		
	send M-data bus to "handset" mode		switch to no hands-free mode
user talks and listens through the portable radiotelephone	monitor both data bus portable radiotelephone and mobile radiotelephone	on - no radio frequency power audio available	
depress "end" key	reads "end-call" command code from portable radiotelephone		
listen to call being dropped	sends "end-call" command code to mobile radiotelephone		terminates call
user replaces portable radiotelephone in the cradle	detects "on-cradle" switch. re-route audio signals in standard configuration mobile radiotelephone		

In step 501 the user powers-on the portable radiotelephone 101 and the portable radiotelephone 101 generates a portable radiotelephone power-on signal onto the P-data bus 102.

Next, in step 503 the controller 107 reads the portable radiotelephone  
5 power-on signal from the P-data bus and commands the mobile radiotelephone 109 to power-on in hands-free mode by sending a command code over the M-data bus 108.

While the user dials a telephone number on the portable radiotelephone 101 this number is transferred over the P-data bus 102,  
10 through the controller 107, across the M-data bus 108, to the mobile radiotelephone 109, as shown in step 505.

Then, in step 507 the mobile radiotelephone receives a send-call command code from the portable radiotelephone 101 then sends an end-call command code to the portable radiotelephone 101 and initiates a  
15 telephone call.

Next, in step 509 the user talks and listens to his intended conversation using the portable radiotelephone 101 in hands-free mode.

Next, in step 511 the controller 107 detects an off cradle status of the portable radiotelephone 101 when the user removes the portable  
20 radiotelephone 101 from the cradle 105, and switches the mobile radiotelephone 109 from a hands-free mode to a handset mode.

Step 513 shows the user talking and listening using the portable radiotelephone 101 in handset mode. When the user has completed his call the user presses the end switch on the portable radiotelephone 101, and an  
25 end-command code is sent from the portable radiotelephone 101 over the P-data bus 102, through the controller 107, and across the M-data bus

108, to the mobile radiotelephone 109 which receives the end-command code and terminates the current telephone call as shown in step 515.

Then, in step 517 an end-call status is displayed on the display 110 of the portable radiotelephone 101.

5       Next, the controller 107 powers off both the mobile radiotelephone 109 and the portable radiotelephone 101.

      An improved architecture for a mobile personal security system and a corresponding method have been detailed above. This approach eliminates the need for an antenna coupler, and a hands-free digital  
10       controller. Furthermore, this approach is convenient for a user because the user can not only use their portable radiotelephone with their mobile personal security system, which allows the user to take advantage of the power output and antenna system from the mobile radiotelephone, but also as a portable radiotelephone away from their  
15       vehicle. Furthermore, the portable unit keeps all personal numbers including turbo-dial numbers which spares the burden of reprogramming the second mobile unit with potentially up to 99 pre-recorded numbers.

      What is claimed is:

### Claims

1. A portable-mobile radiotelephone personal security method for a vehicle comprising the steps of:
  - 5 establishing a telephone call from a portable radiotelephone through a mobile radiotelephone; and
  - aborting the telephone call when a sensing device indicates an emergency condition.

2. A method in accordance with claim 1 further comprising a step of:

establishing an emergency telephone call through the mobile radiotelephone to an emergency-call center, after aborting the  
5 telephone call.

3. A method in accordance with claim 2 further comprising a step of:

transmitting a position of the vehicle to the emergency-call center.  
10

4. A method in accordance with claim 3 further comprising a step of:

displaying status information about the emergency telephone call on a display on the portable radiotelephone.  
15

5. A portable-mobile personal security system for a vehicle comprising:

a sensing device for indicating an emergency condition;

a positioning system providing a position of the vehicle;

5 a portable radiotelephone removable from the vehicle;

a mobile radiotelephone mounted in the vehicle; and

a controller coupling the sensing device, the positioning system, the portable radiotelephone, and the mobile radiotelephone, wherein the controller is operative to abort a telephone call in progress that was  
10 initiated using the portable radiotelephone through the mobile radiotelephone, when the sensing device indicates an emergency condition, and is operable to initiate an emergency telephone call to an emergency-call center to transmit the position of the vehicle provided by the positioning system in response thereto.

6. A system in accordance with claim 5 wherein the positioning system comprises a Global Positioning System (GPS) receiver.

5

7. A system in accordance with claim 5 wherein the sensing device comprises an accelerometer.

8. A system in accordance with claim 5 wherein the sensing  
10 device comprises a switch.



9. A portable-mobile radiotelephone personal security method for a vehicle comprising the steps of:

powering-on a portable radiotelephone, and generating a portable-power-on signal responsive thereto;

5 powering-on a mobile radiotelephone in a hands-free mode responsive to the generated portable-power-on signal;

receiving a telephone number from the portable radiotelephone;

receiving a send-call command code from the portable radiotelephone, then sending an end-call command code from the  
10 mobile radiotelephone to the portable radiotelephone and initiating a telephone call from the mobile radiotelephone; and

receiving an end-command code from the portable radiotelephone and terminating the telephone call initiated through the mobile radiotelephone responsive thereto.

10. A portable-mobile radiotelephone personal security method for a vehicle comprising the steps of:
- initiating a request for an emergency call;
  - 5 powering-on a mobile radiotelephone in a hands-free mode and powering-on a portable radiotelephone responsive to the request for an emergency call;
  - initiating an emergency telephone call to an emergency-call center from the mobile radiotelephone in response to the request for an
  - 10 emergency call;
  - receiving an end-call command code from the emergency call center, and terminating the initiated emergency telephone call responsive thereto;
  - displaying an end-call status on a display of the portable
  - 15 radiotelephone in response to receipt of the end-call command code from the emergency call center; and
  - powering-off both the mobile radiotelephone and the portable radiotelephone after displaying the end-call status on the portable radiotelephone.

11. A method in accordance with claim 10 further comprising  
a step of:

transmitting a position of the vehicle to the emergency-call center.

5

12. A method in accordance with claim 10 further comprising  
a step of:

displaying status information about the emergency telephone call  
on a display on the portable radiotelephone.

10

13. A portable-mobile radiotelephone personal security method for a vehicle comprising the steps of:

powering-on a portable radiotelephone, and generating a portable-power-on signal responsive thereto;

5 powering-on a mobile radiotelephone in a hands-free mode responsive to the generated portable-power-on signal;

receiving a telephone number from the portable radiotelephone;

receiving a send-call command code from the portable radiotelephone, then sending an end-call command code from the

10 mobile radiotelephone to the portable radiotelephone and initiating a telephone call from the mobile radiotelephone;

initiating a request for an emergency call;

aborting the initiated telephone call when a sensing device indicates an emergency condition;

15 initiating an emergency telephone call to an emergency-call center from the mobile radiotelephone in response to the request for an emergency call;

receiving an end-call command code from the emergency call center, and terminating the initiated emergency telephone call

20 responsive thereto; and

powering-off both the mobile radiotelephone and the portable radiotelephone after displaying the end-call status on the portable radiotelephone.

14. A method in accordance with claim 13 further comprising  
a step of:

transmitting a position of the vehicle to the emergency-call center.

5 15. A method in accordance with claim 14 further comprising  
a step of:

displaying status information about the emergency telephone call  
on a display on the portable radiotelephone.

16. A portable-mobile radiotelephone personal security method for a vehicle comprising the steps of:

powering-on a portable radiotelephone, and generating a portable-power-on signal responsive thereto;

5 powering-on a mobile radiotelephone in a hands-free mode responsive to the generated portable-power-on signal;

receiving a telephone number from the portable radiotelephone;

receiving a send-call command code from the portable radiotelephone, then sending an end-call command code from the mobile radiotelephone to the portable radiotelephone and initiating a telephone call from the mobile radiotelephone in response to receiving a send-call command code;

10 detecting an off-cradle status of the portable radiotelephone and switching the mobile radiotelephone from hands-free mode to a handset mode;

15 receiving an end-command code from the portable radiotelephone and terminating the telephone call initiated through the mobile radiotelephone responsive thereto; and

displaying an end-call status on a display of the portable radiotelephone in response to receipt of the end-command code; and

20 powering-off both the mobile radiotelephone and the portable radiotelephone after displaying the end-call status on the portable radiotelephone.

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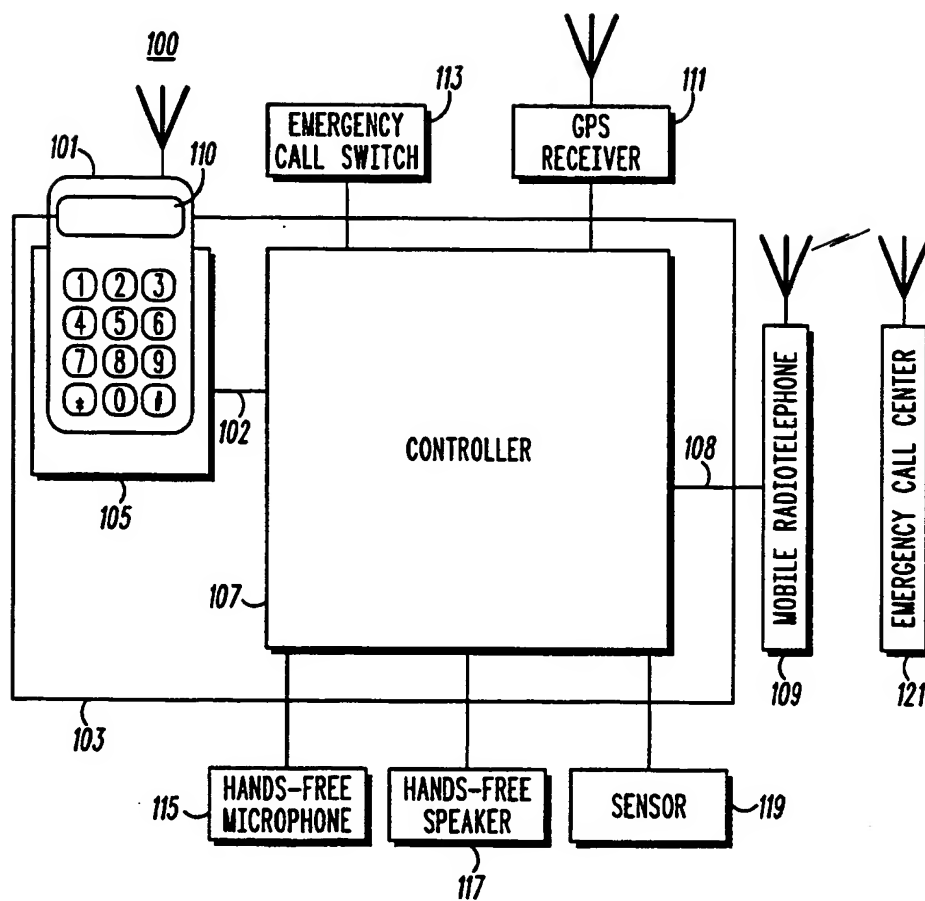


FIG. 1

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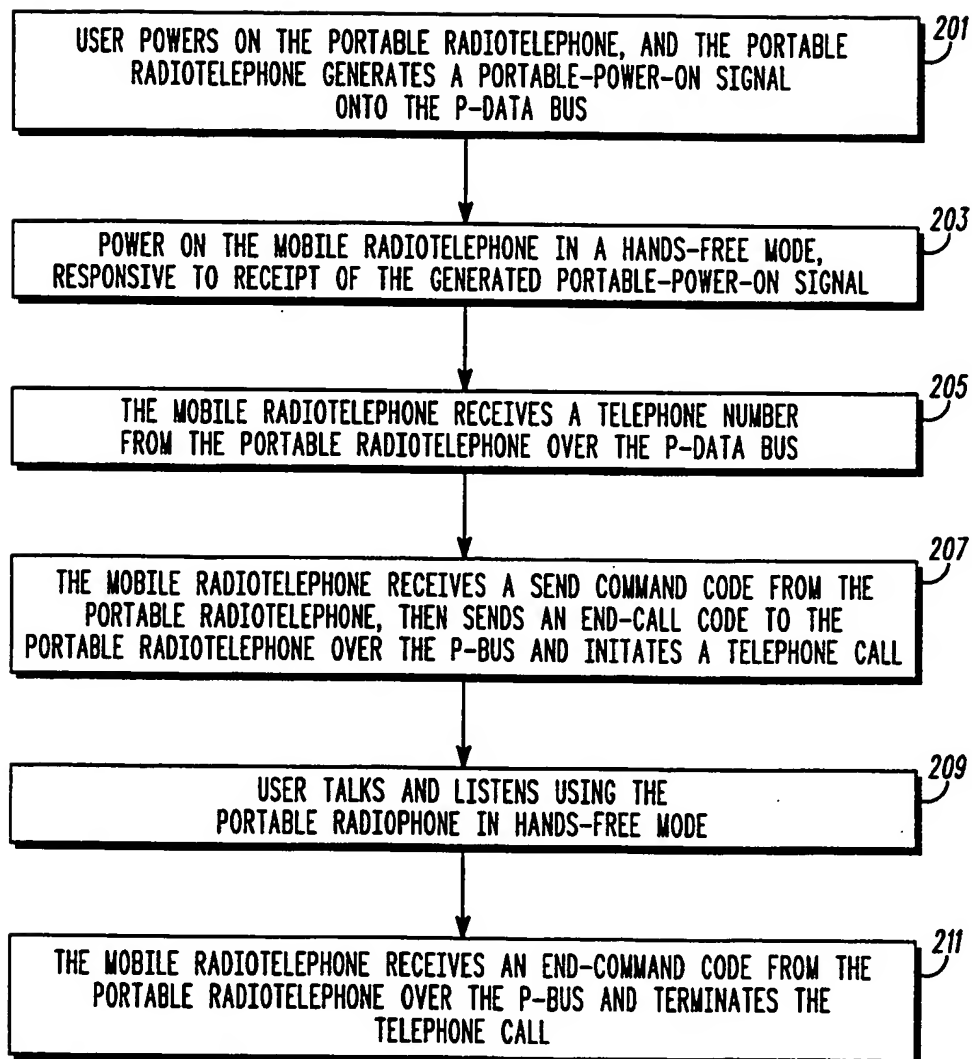


FIG.2



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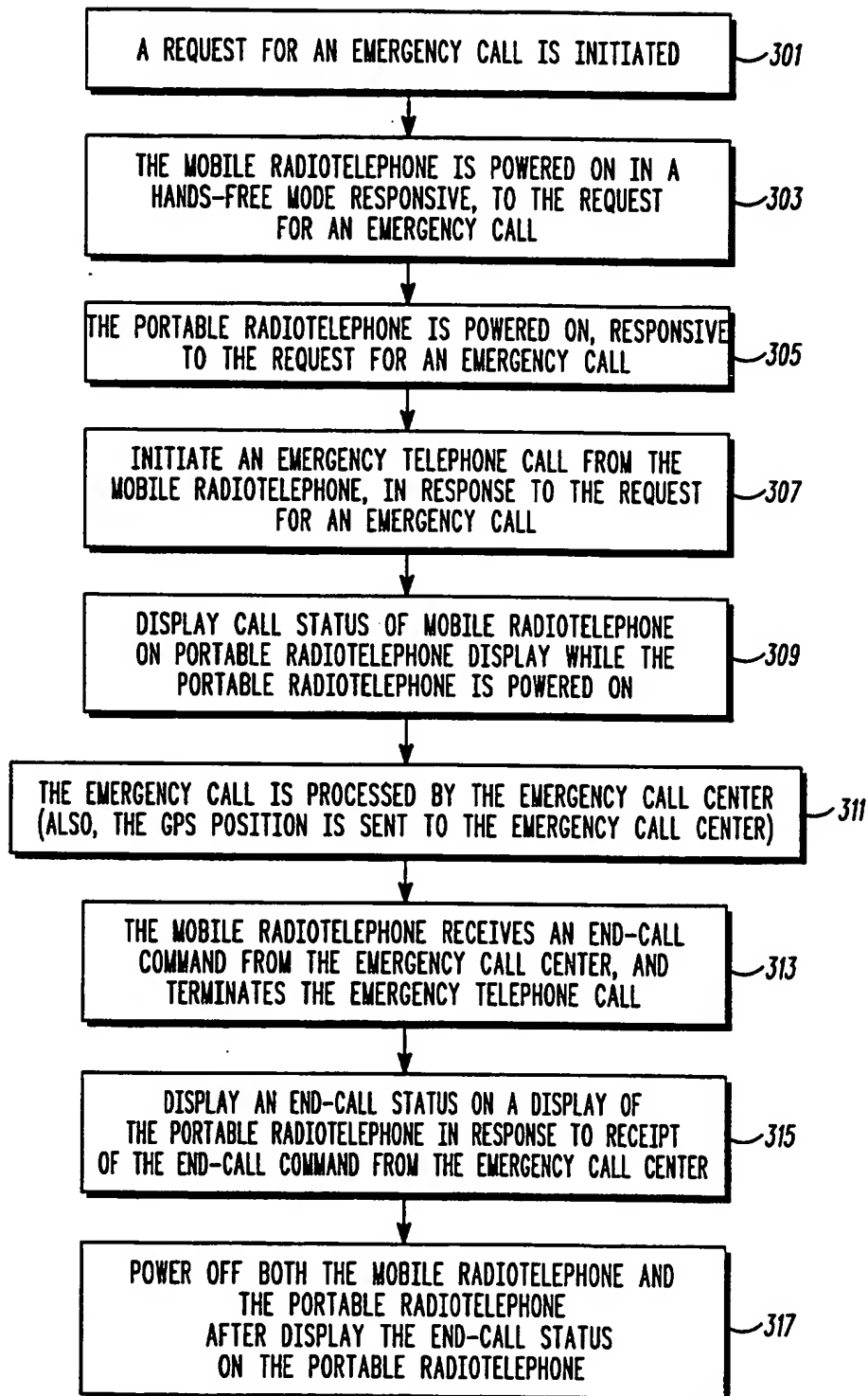


FIG.3

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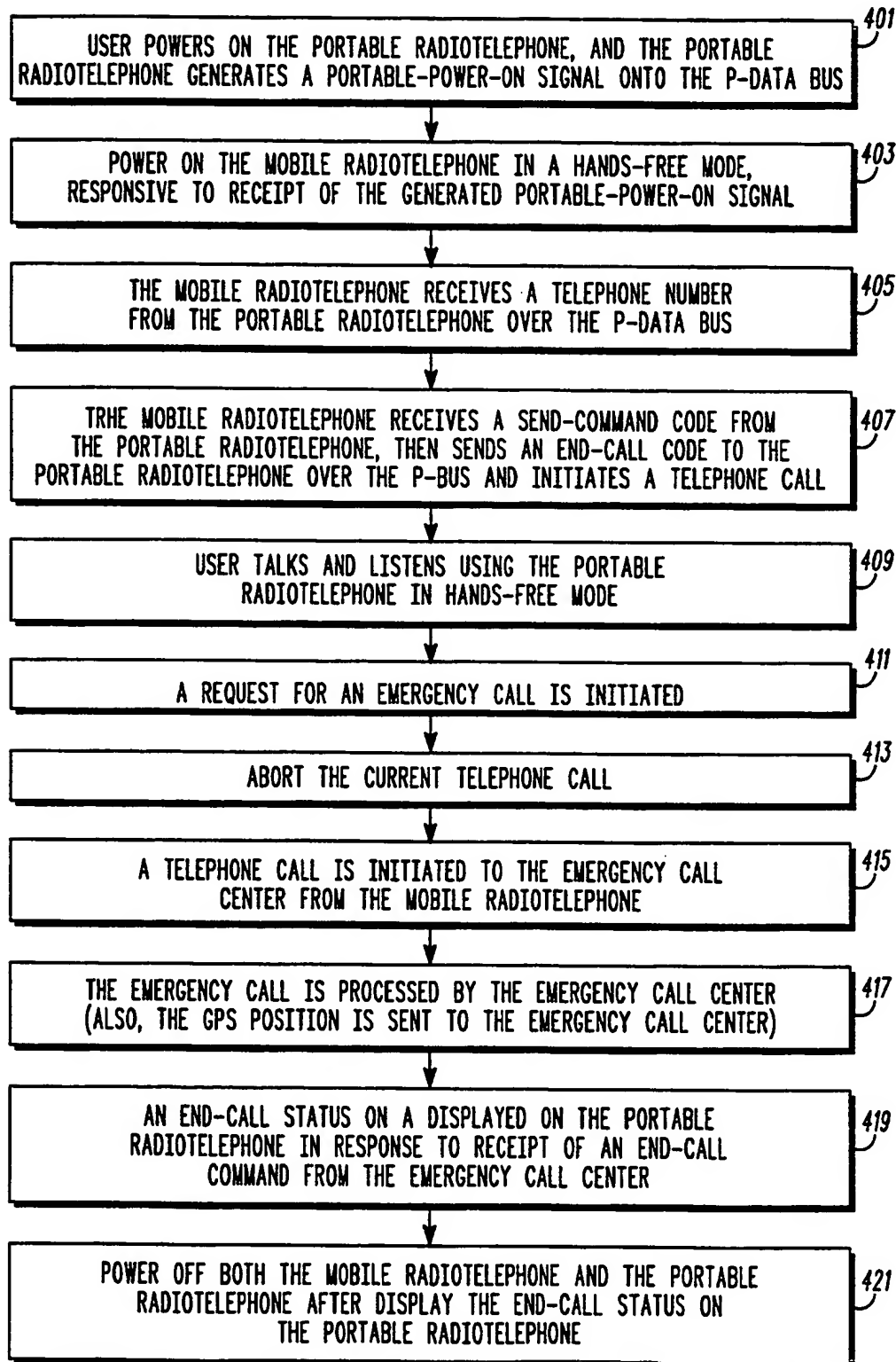


FIG.4

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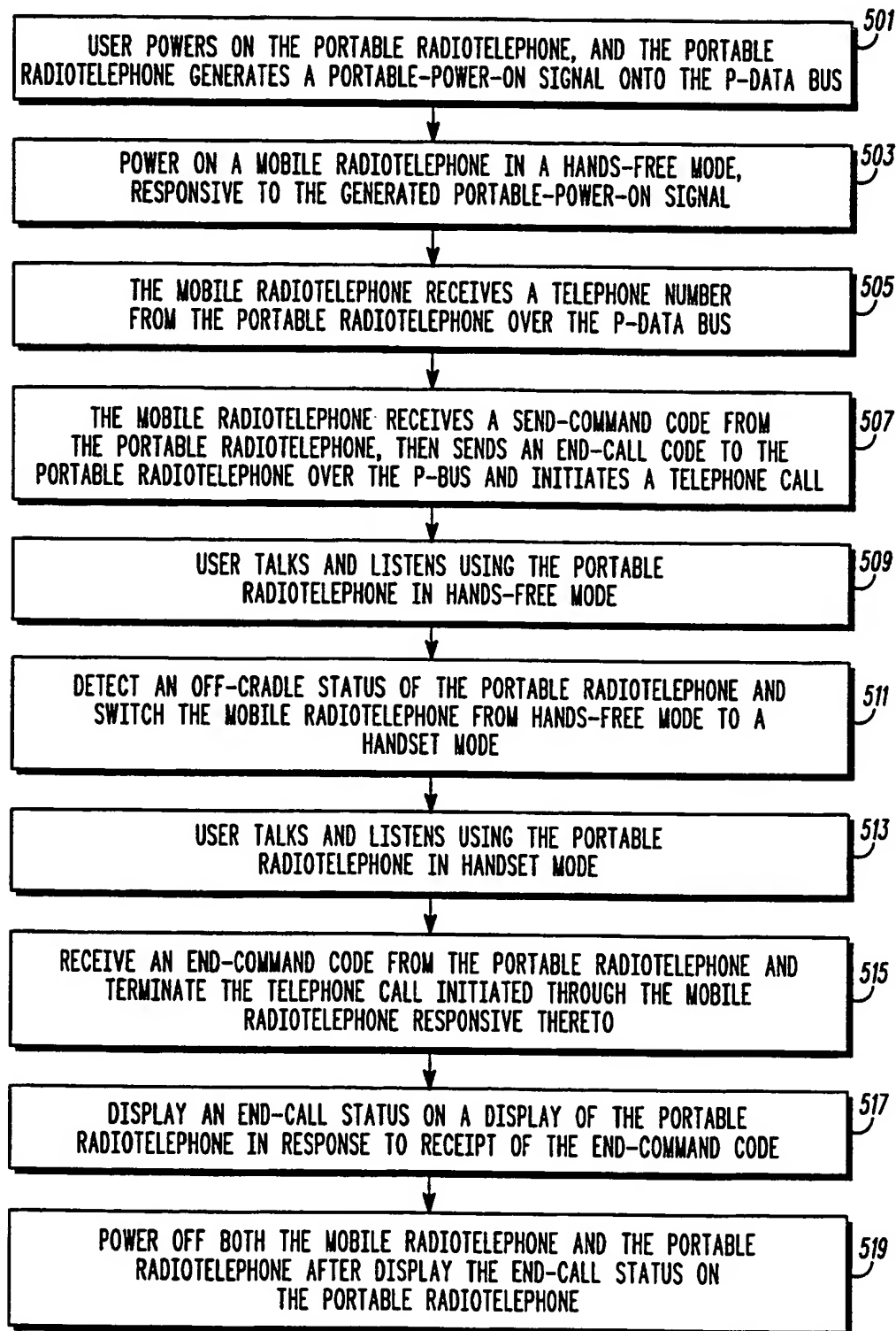



FIG.5

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US98/13874

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC(6) :H04M 11/00 US CL :455/404, 414, 432, 439, 445, 456, 517; 379/45 According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) U.S. : 455/404, 414, 432, 439, 445, 456, 517; 379/45 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) APS		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,797,093 A (HOUE) 18 AUGUST 1998, COL. 2, LINES 30-54.	1-16
A	US 5,687,215 A (TIMM ET AL) 11 NOVEMBER 1997, COL. 1, LINE 60 - COL. 2, LINE 30.	1-16
A	US 5,631,642 A (BROCKELSBY ET AL) 20 MAY 1997, COL. 2, LINES 3-65.	1-16
A	US 5,465,388 A (ZICKER) 7 NOVEMBER 1995, FIG. 6.	1-16
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document published on or after the international filing date "I" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "A" document member of the same patent family	
Date of the actual completion of the international search 30 SEPTEMBER 1998		Date of mailing of the international search report 02 NOV 1998
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230		Authorized officer SAM BHATTACHARYA  Telephone No. (703) 305-4040